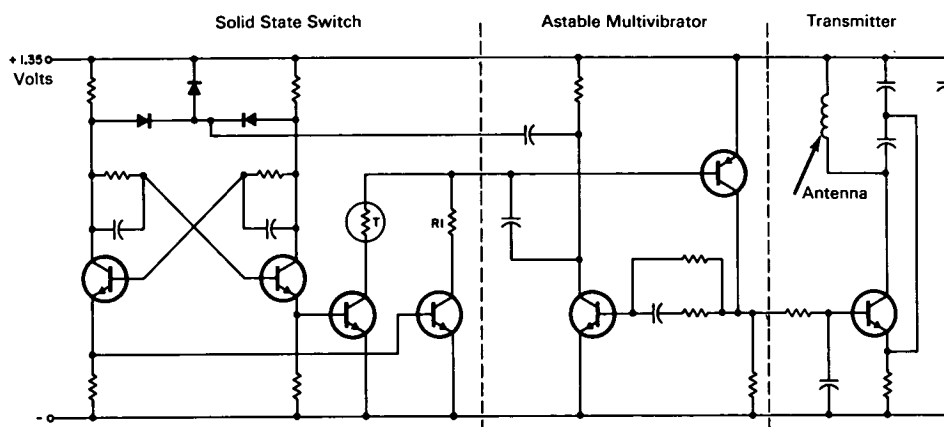


# NASA TECH BRIEF



NASA Tech Briefs are issued to summarize specific innovations derived from the U. S. space program and to encourage their commercial application. Copies are available to the public from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Miniature Bioelectronic Device Accurately Measures and Telemeters Temperature



### The problem:

To design a microminiature implantable instrument that will continuously and accurately measure and telemeter the body temperature of laboratory animals over periods up to two years. The implanted instrument must be impervious to attack by body fluids and have a negligible effect on the physical activity of the animal.

### The solution:

A miniature micropower solid-state circuit employing a thermistor as a temperature sensing element (with a compensating resistor) and a FM transmitter. The circuit is designed to be very stable for a long period and to be accurate to within  $0.1^{\circ}\text{C}$ . The instrument may be constructed from conventional discrete components or integrated circuits. A special feature of the instrument with integrated circuitry is that the

electronic components are sealed in a metal can, separate from the battery, so that seal rupture due to battery out-gassing is not a problem.

### How it's done:

The circuit operates in the FM broadcast band and may be used with a commercial FM receiver. It transmits 15-microsecond pulses spaced 8 to 20 milliseconds apart, depending on the temperature being monitored ( $45^{\circ}$  to  $30^{\circ}\text{C}$ ). The average current drain of the circuit is approximately 7.4 microamperes at 1.35 volts.

A bistable multivibrator alternately switches the temperature sensor (a thermistor and a standard resistor, R1) into the frequency determining circuit of the astable multivibrator. The demodulator produces an output proportional to the ratio of the pulses obtained from the thermistor and the standard resistor.

(continued overleaf)

This ratio is used to compensate for variations in battery voltage and component values.

The integrated circuit employs a ferrite-core antenna to concentrate the rf field and prevent induction effects in the battery. The ferrite core also serves as a holder for the battery, and both components, mounted outside of the circuitry container, are sealed in wax.

**Notes:**

1. Although designed primarily for measuring and telemetering body temperature, the circuit can be easily modified to allow differential monitoring of other variables. The system can be extended to measurement of several variables (voltages) by replacing the bistable multivibrator with a ring counter.

2. A related invention is described in NASA Tech Brief B64-10171, October 1964. Inquiries may also be directed to:

Technology Utilization Officer  
Ames Research Center  
Moffett Field, California, 94035  
Reference: B66-10057

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code AGP, Washington, D.C., 20546.

Source: Thomas B. Fryer  
(ARC-52)